

## Activity 3

### Orbits and Effects

#### Think About It

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- What is the shape of the Earth's orbit around the Sun?
- How might a change in the shape of the Earth's orbit or its axis of rotation affect weather and climate?



# WHAT DO YOU THINK?

## Activity 3

### Investigate

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### 3. Data Table

Ellipse	Major Axis (L)	Distance (d)	Eccentricity $E = d/L$
AB		10	
CD		8	
EF		6	
GH		4	
IJ		2	

4a. Record the relationship between the distance and the eccentricity.

4b. Does the distance to the center of the sun stay the same in any orbit?

4c. Which orbit has the least variation in distance from the sun throughout its orbit? Which has the most?

5a. Why does it make sense to describe Earth's orbit as "nearly circular"?

## Activity 3

### Orbits and Effects

#### Digging Deeper

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Axis

the imaginary vertical line around which Earth spins

The poles

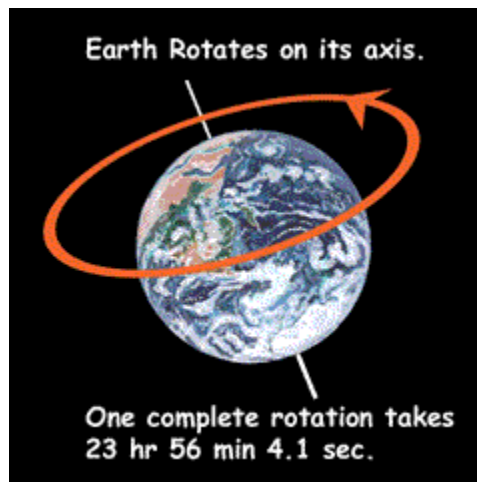
are located at the north and south ends of Earth's axis

#### Rotation

the spinning of Earth on its axis

Earth's rotation causes day and night to occur

One rotation of Earth on its axis takes about 24 hours, or one day



#### Revolution

Earth's yearly orbit around the sun

#### Ellipse

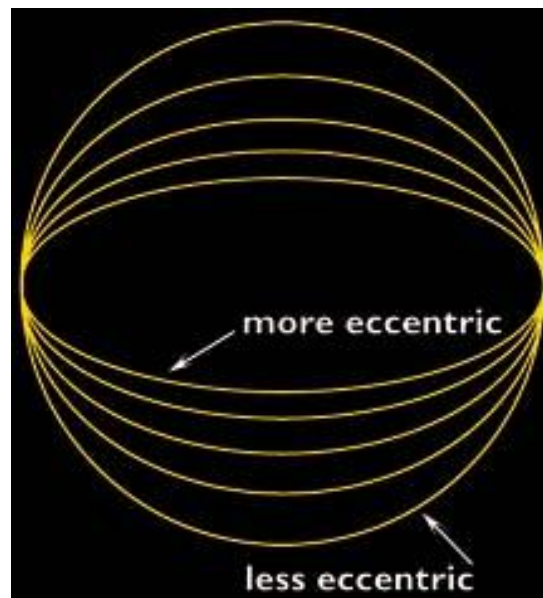
an elongated, closed curve (like an oval)

The shape of Earth's orbit around the sun

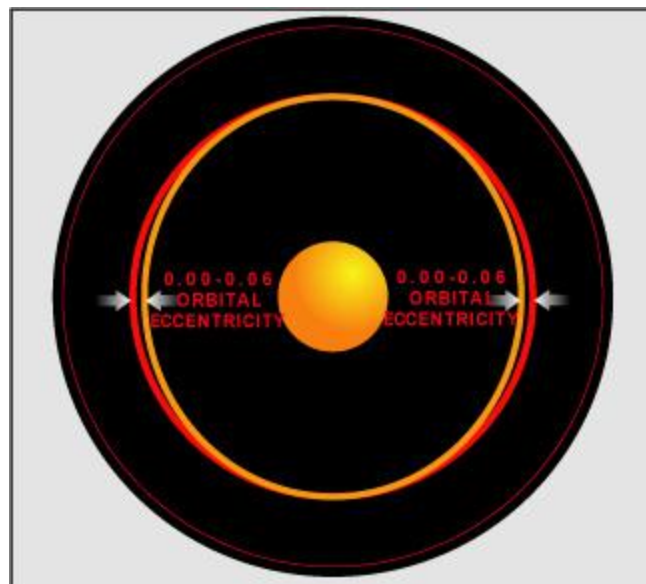
## Eccentricity

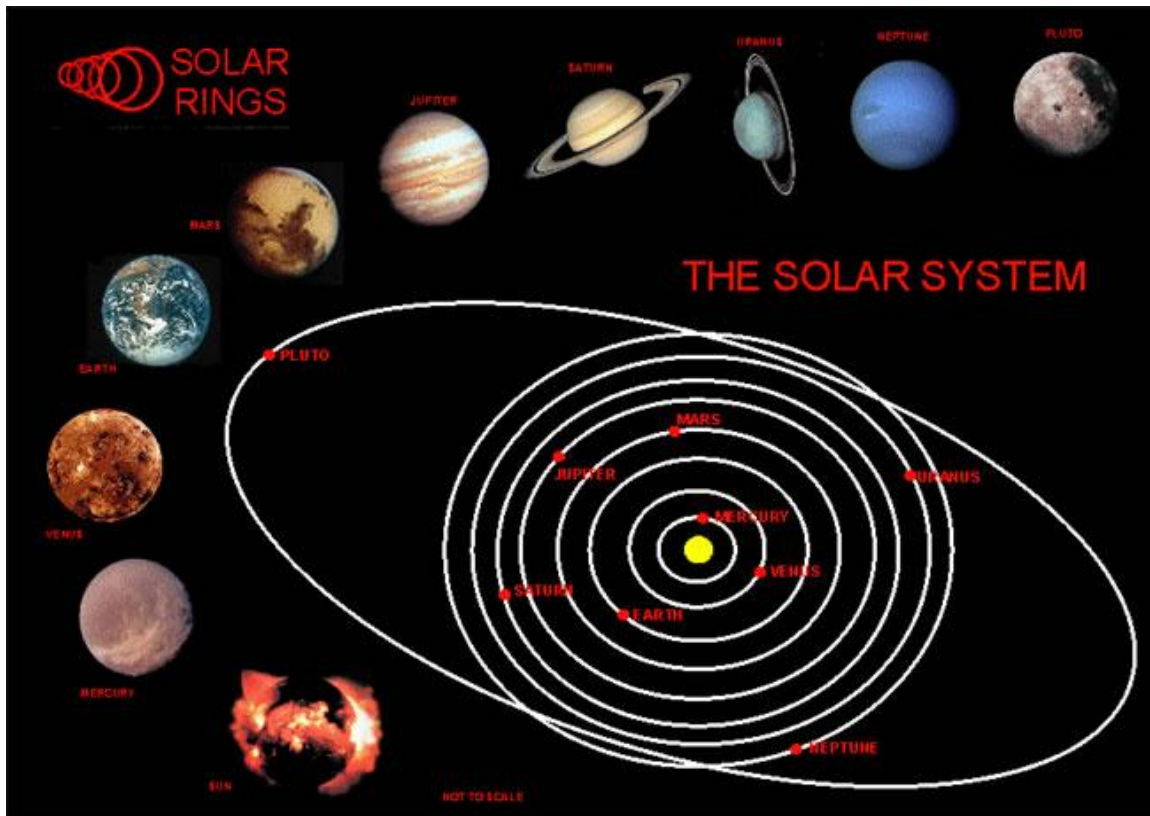
describes the shape of an ellipse

The more flattened the ellipse is, the greater its eccentricity



Earth's yearly orbit around the sun has an eccentricity of 0.017 (almost a circle)





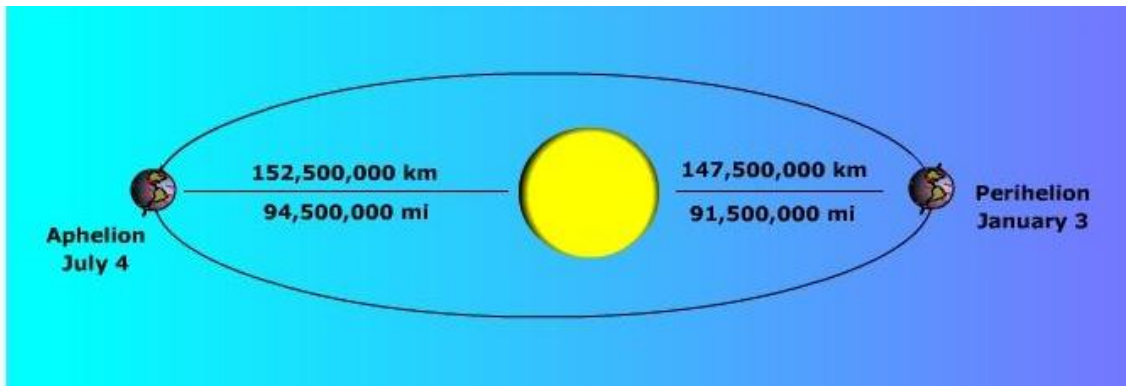
The sun is not at the center of the ellipse— instead, it is a little toward one end

Because of this, the distance between the Earth and the sun changes during Earth's orbit

Closest Earth is closest to the sun (about 147 million km away) around January 3

Farthest Earth is farthest from the sun (about 153 million km away) on July 4

[http://www.classzone.com/books/earth\\_science/terc/content/visualizations/es0408/es0408page01.cfm?chapter\\_no=04](http://www.classzone.com/books/earth_science/terc/content/visualizations/es0408/es0408page01.cfm?chapter_no=04)



Amount of sunlight

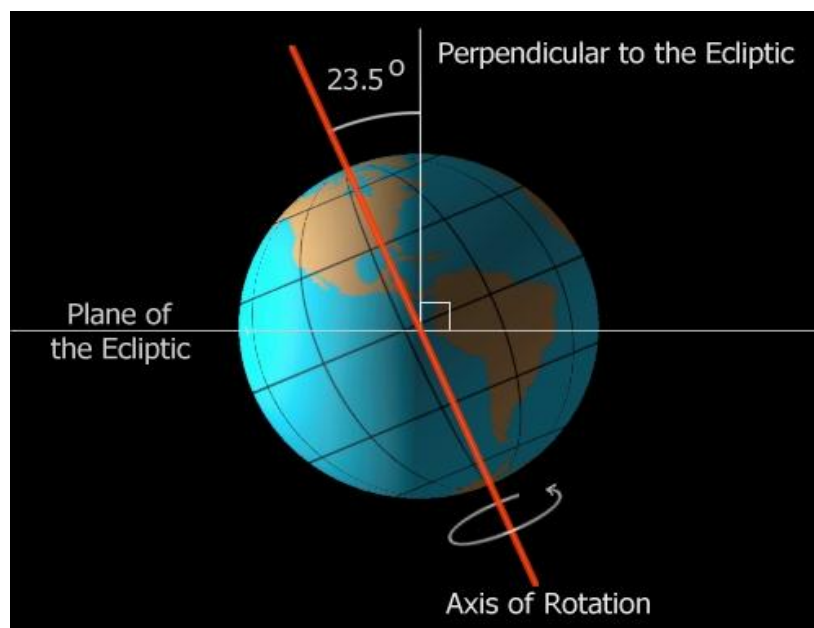
Earth is exposed to almost the same amount of sun all year

However, the amount of solar energy that any one place on Earth receives differs greatly during the year

Earth's axis

is tilted  $23.5^\circ$

This tilt causes the seasons



## Earth's tilt

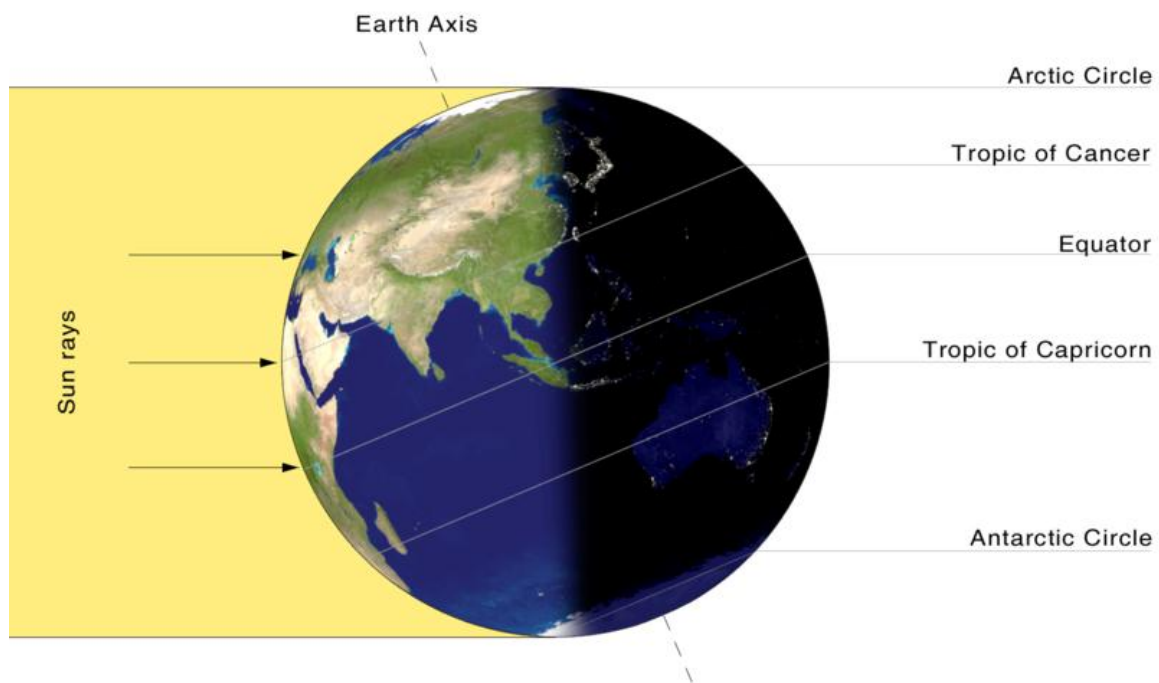
the number of daylight hours is greater for the hemisphere that is tilted toward the sun than the hemisphere that is tilted away from the sun

It also causes radiation from the sun to strike the hemispheres at different angles

higher angle ( $90^\circ$ ) = more sunlight  
lower angle = less sunlight

## Summer

occurs in the hemisphere tilted toward the sun, because the sun's radiation strikes the Earth at a higher angle and for longer periods of time





Winter

occurs in the hemisphere tilted away from the sun, because the sun's radiation strikes at a low angle for shorter periods of time

## Solstice

the day when the sun reaches its greatest distance north or south of the equator

Northern hemisphere

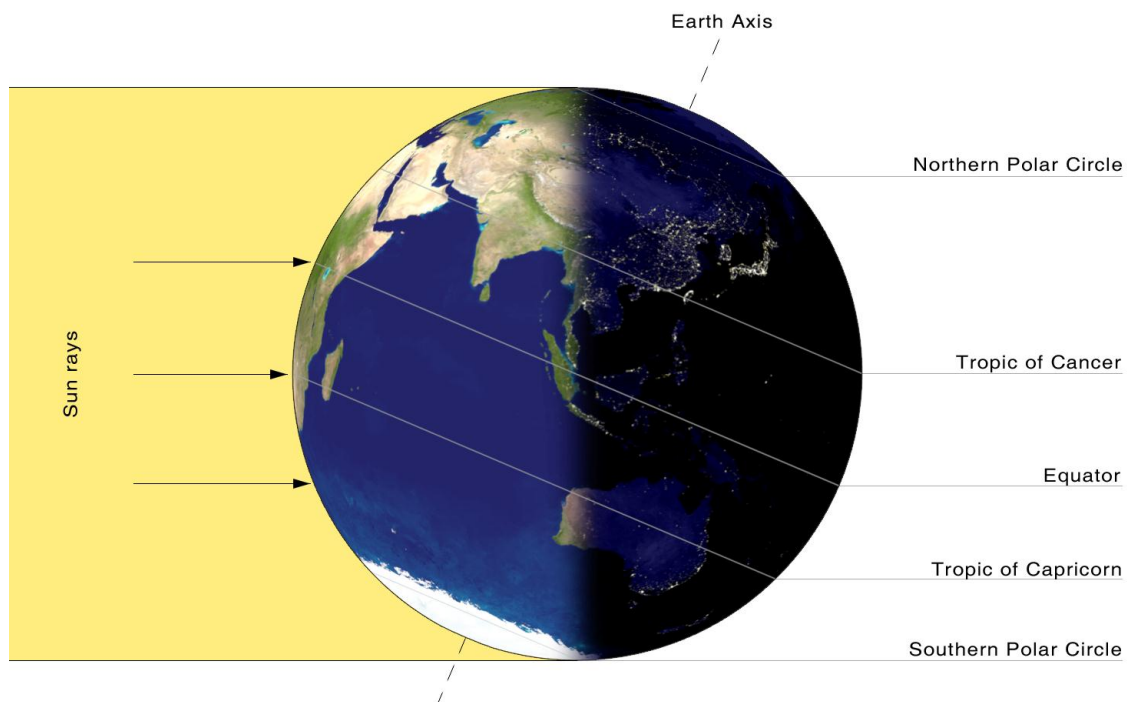
summer solstice occurs on June 21 or 22

Winter solstice occurs on December 21 or 22

Southern hemisphere

summer solstice occurs on December 21 or 22

Winter solstice occurs on June 21 or 22





Summer solstice

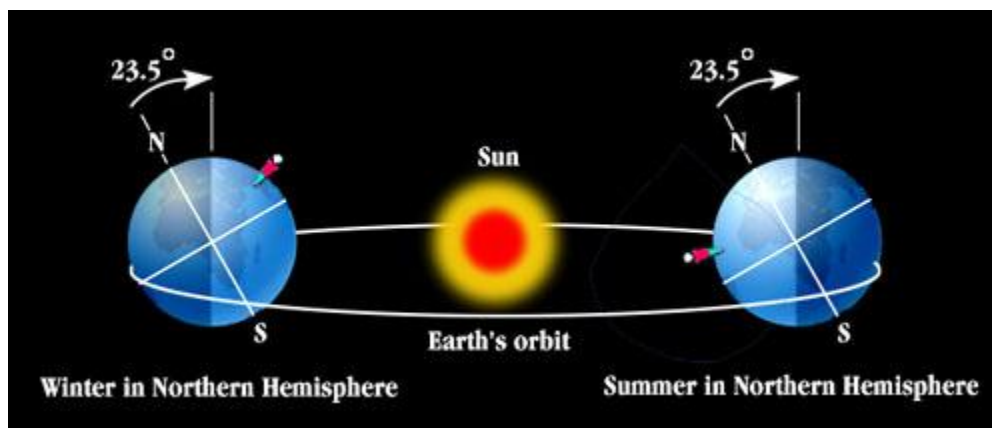
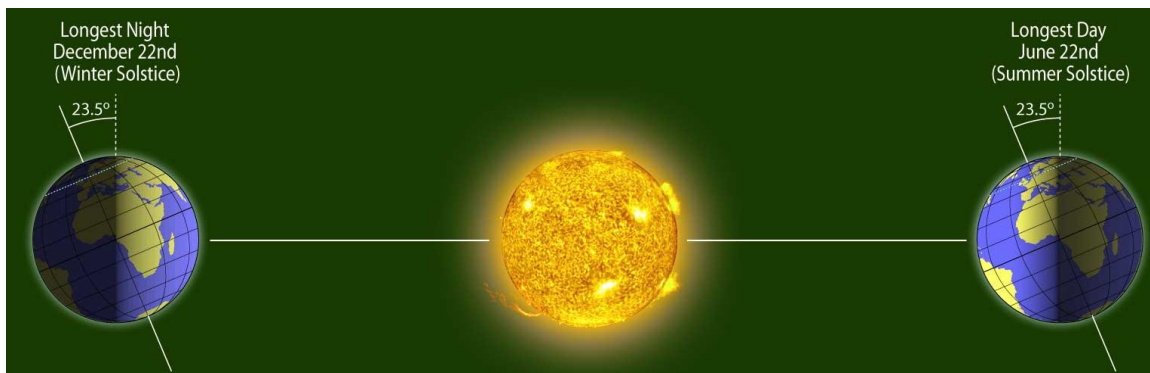
the longest day of the year

After this, the number of daylight hours decreases until the winter solstice

Winter solstice

the shortest day of the year

After this, the number of daylight hours increases until the summer solstice

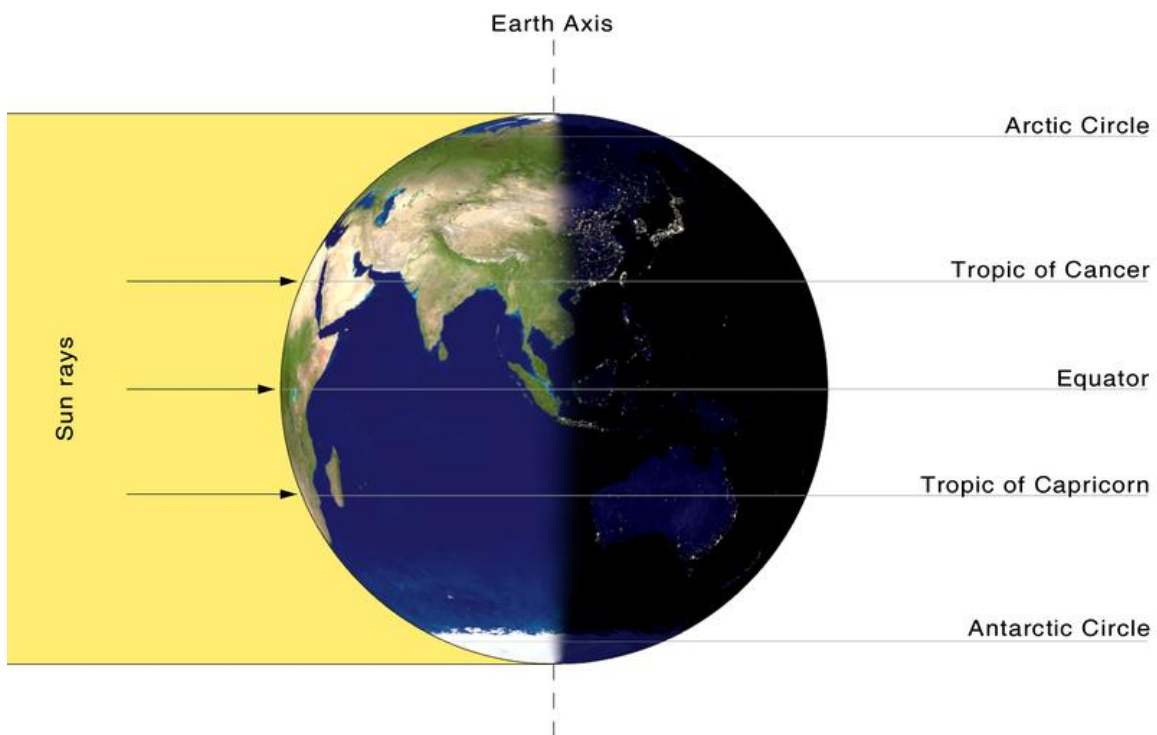


**Equinox**

occurs when the sun is directly over Earth's equator

The number of daylight hours and nighttime hours are nearly equal all over the world

Neither the northern hemisphere nor the southern hemisphere is tilted toward the sun

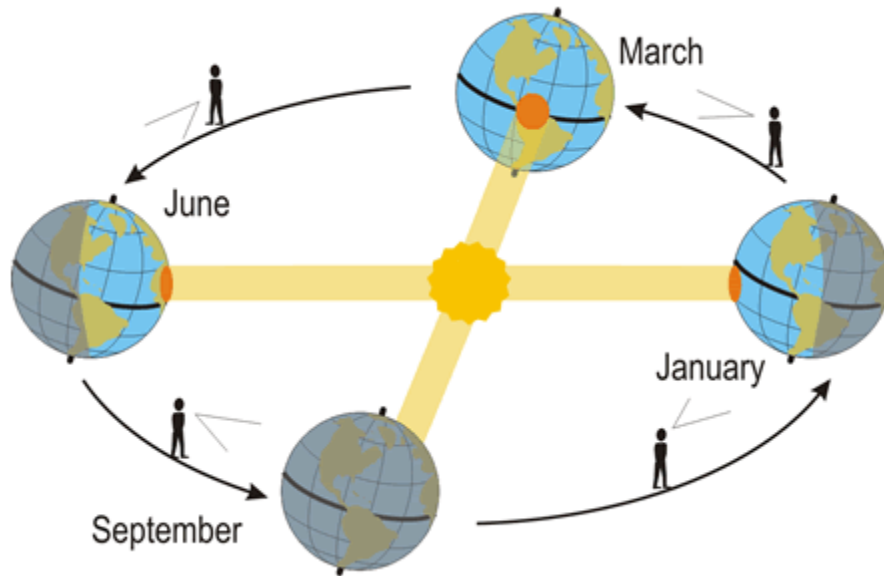


Northern hemisphere      the spring (vernal) equinox occurs on March 20 or 21

The fall (autumnal) equinox occurs on September 22 or 23

Southern hemisphere      the spring equinox occurs on September 22 or 23

The fall equinox occurs on March 20 or 21



<http://www.brainpop.com/science/earthsystem/solsticeandequinox/>

## Orbits and Effects

### Check Your Understanding

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1. Explain what is meant by the eccentricity of an ellipse in your own words.

2. For an ellipse with a major axis of 25 cm, which is more eccentric; the one with the distance of 15 cm or 20 cm? Explain.

3. How does the precession of the Earth's axis of rotation affect the seasons?

4. Why is there a danger that a large asteroid might strike the Earth at some time in the future?